Instruction Manual & Warranty Information

AccuForce® III

DIGITAL FORCE GAUGE

AMETEK
MANSFIELD & GREEN DIVISION

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1.0 INTRODUCTION

A. Precautions

- Read instruction manual completely before using the AF-III.
- Do not overload the AF-III. The AF-III has an overload capacity of 50% of the rated full scale. The Display on the AF-III will read OVERLOAD when the AF-III is overloaded. The rated full scale load is shown on the Capacity Label on the front of the AF-III.
- Turn off the AF-III before connecting or disconnecting any cables to the AF-III.
- A warm up time of 2-5 minutes is recommended for the AF-III.
- Recharge the batteries per instructions in section II.A before using the AF-II! for the first time.
- Do not disassemble the AF-III. Disassembly voids the warranty.
- Attachments provided with the AF-III should be installed fingertight. Do not tighten with tools as a torque load on the Load Shaft could damage the measuring system.
- Be sure to use the most appropriate attachment for the given application.
- The AF-III is designed for axial loading. Applying load on an angle or eccentric loading may cause an erroneous reading.

B. Description

1. General Description

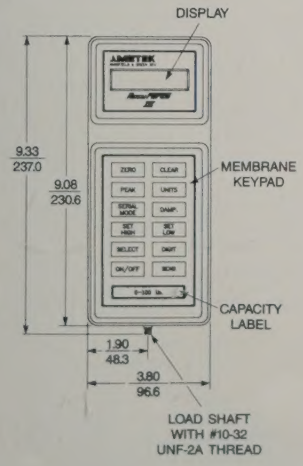
The AccuForce III Digital Force Gauge is a precision instrument designed and constructed for long life. By following these instructions, optimum accuracy and performance can be attained.

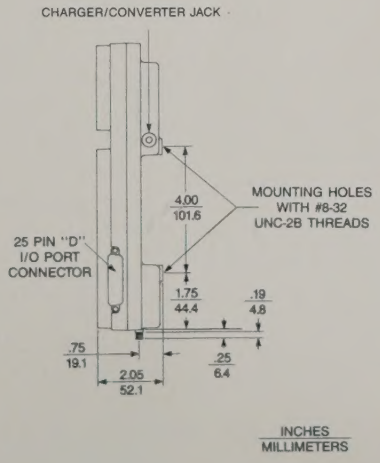
2. Features

- 1000 updates per second allows peaks to be captured over 30 times faster than other force gauges.
- ±0.2% ± 1 LSD (least significant digit) accuracy
- Set-up parameters permit user configuration. All set-up parameters are stored in non-volatile memory.
- Interfaces directly to any device capable of accepting RS-232, Mitutoyo, or analog input.
- Functions can be controlled from the keyboard or remotely through the serial port.

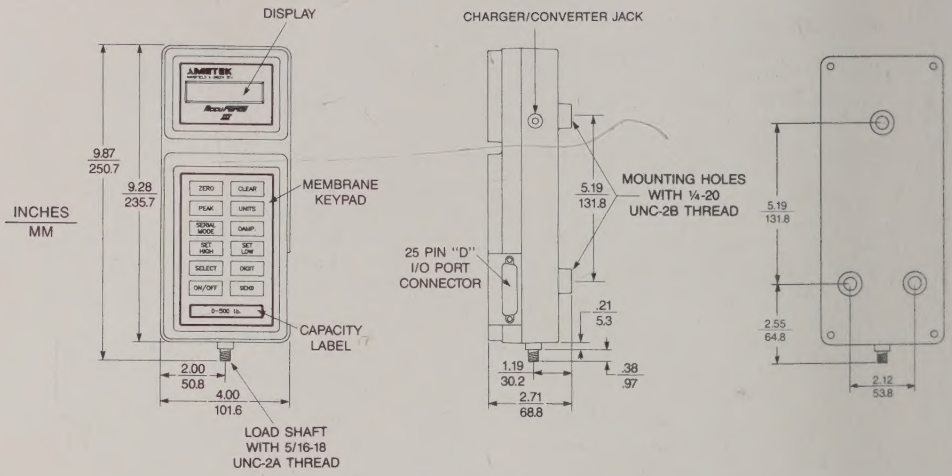
3. Dimensions and Nomenclature

Capacities 100 lb. and below:





Capacities above 100 lb.:



II. OPERATION

A. Recharging

The AF-III contains an internal rechargeable Nickel Cadmium (Ni-Cad) battery pack capable of powering the AF-III for 6-8 hours on a full charge. When batteries are low, the Display on the AF-III will flash BATTERY every four seconds. Operation of the AF-III when the batteries are low will produce unpredictable results.

To recharge the batteries:

1. Turn the AF-III off.
2. Insert the phono plug from the Charger/Converter into the Charger/Converter Jack on the AF-III.
3. Plug the Charger/Converter into a proper AC voltage outlet. The input AC voltage and frequency requirements are listed on the Charger/Converter.
4. Allow batteries to charge for 16 to 18 hours.

The batteries supplied with the AF-III should accept 1000 recharge cycles.

B. Set-up

To set up the AF-III for use:

1. Verify the AF-III is turned off (see II.C.1).

2. If you will be powering the AF-III from the line:

a. Insert the phono plug from the Charger/Converter into the Charger/Converter jack on the AF-III.

b. Plug the Charger/Converter into a proper AC voltage outlet. The input AC voltage and frequency requirements are listed on the Charger/Converter.

If you will be powering the AF-III from batteries:

a. Charge the batteries per II.A if necessary.

3. Attach all necessary cables to the I/O Port.

4. Proceed to II.C.1.

C. AF-III Functions

1. Turning On and Off

Set-up parameters as well as calibration and configuration information for the AF-III are loaded from nonvolatile storage when the AF-III is turned on and saved to nonvolatile storage when the AF-III is turned off.

To turn the AF-III on, momentarily press the ON/OFF key on the Membrane Keypad. The AF-III will respond by sounding a short tone, displaying ON for approximately two seconds and then begin displaying the present force readings. A warm-up time of 2-5 minutes is recommended.

To turn the AF-III off, momentarily press the ON/OFF key on the Membrane Keypad. The AF-III will respond by displaying OFF for approximately two seconds and then turn itself off.

2. Changing Units of Measure

Force readings can be displayed in a variety of units of measure (see III.A for more information). The units of measure are shown on the two right-most characters of the Display.

To change the units of measure, momentarily press the UNITS key on the Membrane Keypad. The AF-III will respond by displaying the next available units of

measure and converting all readings (present, peak compression, peak tension, high set point, low set point, etc.) to the new units of measure. Continue this procedure until the units of measure you wish is shown.

3. Zeroing

Zeroing (taring) permits accessories and attachments to be excluded from the force readings. Up to 20% of the rated full scale may be zeroed (tared) out. The rated full scale is shown on the Capacity Label on the front of the AF-III.

To zero the AF-III, momentarily press the ZERO key on the Membrane Keypad. The AF-III will respond by establishing the present force reading as zero and clearing the peak compression and peak tension readings.

4. Displaying Peak Readings

During operation the AF-III is continuously tracking the highest peak compression and highest peak tension readings. The PEAK button permits displaying the peak compression or peak tension reading. Readings are displayed in a last in-first out order. That is, the last value (peak compression or peak tension) displayed before exiting the Peak function is always the first value displayed when the Peak function is entered. This technique minimizes the number of key presses necessary when tests are being performed in one direction only, while maintaining independence from the direction.

To display the peak compression or peak tension reading, momentarily press the PEAK key on the Membrane Keypad. The AF-III will respond by displaying the label for the peak reading to be displayed (PEAK C for peak compression or PEAK T for peak tension) for one second and then display that peak reading. Every four seconds the label (PEAK C or PEAK T) will flash on the Display to remind you what value you are viewing. To cycle to the opposite peak value, momentarily press the SELECT key on the Membrane Keypad. The AF-III will respond by displaying the label for the peak reading to be displayed (PEAK C for peak compression or PEAK T for peak tension) for one second and then display that peak reading. As mentioned previously, the label (PEAK C or PEAK T) will flash on the Display every four seconds to remind you what value you are viewing.

To exit the Peak function and return to displaying the present force readings, momentarily press the PEAK key on the Membrane Keypad. The AF-III will respond by returning to displaying the present force readings.

If you wish to watch the peak increasing as the test is performed instead of recalling it after the test is complete, simply follow the procedure above for displaying a force reading before performing the test. Both techniques produce the same result so user preference dictates which one to use.

5. Clearing Peak Readings

At the completion of a test, the peak readings are generally cleared (reset) for the next test.

To clear both the peak compression and peak tension reading at the same time, momentarily press the CLEAR key on the Membrane keypad while displaying the present force readings (that is while not displaying one of the peak readings). The AF-III will respond by clearing both the peak compression and peak tension reading.

To selectively clear the peak compression or the peak tension reading, momentarily press the CLEAR key on the Membrane Keypad while displaying the peak reading (peak compression or peak tension) you wish to clear (see II.C.4 for instructions on how to display a peak reading). The AF-III will respond by clearing only the peak reading (peak compression or peak tension) being displayed.

6. Setting High and Low Set Points

High and low set points provide visual indication, status indication (see III.B.4 for further information) and audible indication (can be turned on or off) when the AF-III has reached or exceeded a high or low set point limit or both. The actual values of the set points can be configured. The primary difference between a high set point and a low set point is that values mathematically above the high set point trigger the high set point condition and values mathematically below the low set point trigger the low set point condition. Since the AF-III reports compression values as positive numbers and tension values as negative numbers, the high set point will generally be used to indicate when a maximum compression value has been reached or exceeded, and the low set point will generally be used to indicate when a maximum tension value has been reached or exceeded. An explanation of how to configure the high set

point follows. To configure a low set point, substitute the SET LOW key for the SET HIGH key in this explanation.

To view the present value for the high set point, momentarily press the SET HIGH key on the Membrane Keypad. The AF-III will respond by displaying the present value of the high set point and you will notice a cursor flashing on the right-most digit. To change the value for the high set point, two keys are used. Momentarily pressing the SELECT key increments the value the cursor is on by one if the cursor is over a numerical value or, if the cursor is over the sign position (left-most character on the Display), toggles the sign between blank (for positive) and - (for negative). Momentarily pressing the DIGIT key moves the cursor one position to the left. Therefore, to change the value for the high set point, simply use the DIGIT key to move the cursor to the positions you wish to change and use the SELECT key at each of these positions to increment the value at the position until the value you wish is shown.

To exit the High set point function and return to displaying the present force readings, you must first select whether the audible indication will be on or off. To exit the High set point function and enter the audible indication selection function, momentarily press the SET HIGH key on the Membrane Keypad. The AF-III will respond by displaying the present selection for the audible indication (AUD. ON or AUD. OFF). To change the setting for the audible indication, momentarily press the SELECT key on the Membrane Keypad. The AF-III will respond by displaying the opposite selection.

To exit the audible indication selection function and return to displaying the present force readings, momentarily press the SET HIGH key on the Membrane Keypad. The AF-III will respond by returning to displaying the present force readings and implementing your selections for the high set point and audible indication.

7. Setting Dampening

Due to the extremely fast update rate of the AF-III (1000 Hz), minor vibrations not related to the test may be picked up by the AF-III causing the present reading to "jump around". If this is not desireable and it is not possible to isolate the AF-III from these vibrations, the AF-III may be set-up to dampen the readings. Dampening of readings is an averaging function that affects only the present readings. DAMPENING DOES NOT AFFECT THE PEAK COMPRESSION OR PEAK TENSION READING. To view the present setting for the dampening, momentarily press the DAMP. key on the Membrane Keypad. The AF-III will respond by displaying the present setting for the dampening (DAMP ON or DAMP OFF). To change the setting for the dampening, momentarily press the SELECT key on the Membrane Keypad. The AF-III will respond by displaying the opposite selection.

To exit the Dampening function and return to displaying the present force readings, momentarily press the DAMP key on the Membrane Keypad. The AF-III will respond by returning to displaying the present force readings and implementing your selection for the dampening.

8. Setting Serial Port Configuration

The AF-III can communicate serially with devices capable of accepting an RS-232 or Mitutoyo input. The Serial Port Configuration allows you to configure the serial port for communicating with RS-232 devices at 300, 600, 1200, 2400, 4800 or 9600 Baud or communicating with Mitutoyo devices. See I/O Port specifications in III.B.2 and III.B.3 for further information.

To view the present setting for the serial port, momentarily press the SERIAL MODE key on the Membrane Keypad. The AF-III will respond by displaying the present setting for the serial port (300BAUD, 600BAUD, etc.). To change the setting for the serial port, momentarily press the SELECT key on the Membrane Keypad. The AF-III will respond by displaying the next available serial port configuration setting. Continue changing the setting until the serial port configuration setting you wish is shown.

To exit the Serial port configuration function and return to displaying the present force readings, momentarily press the SERIAL MODE key on the Membrane Keypad. The AF-III will respond by returning to displaying the force readings and implementing your selection for the serial port configuration setting.

9. Transmitting Readings

The Transmit feature allows readings to be transmitted one at a time to an RS-232 or Mitutoyo device connected to the I/O Port on the AF-III. See I/O Port specifications

in III.B.2 and III.B.3 for further information.

To transmit a reading, momentarily press the SEND key on the Membrane Keypad. The AF-III will respond by transmitting the reading on the display to the RS-232 or Mitutoyo device connected to the I/O Port.

10. Displaying Serial Number

One of the items contained in the non-volatile storage is the serial number for the AF-III. In the event you have a problem with the AF-III, you may be requested by support personnel to recall this serial number. Or, you may use this serial number for your own internal tracking or auditing.

To view the serial number, momentarily press the Digit key then momentarily press the Select key and finally momentarily press the Digit key one more time. The AF-III will respond by displaying the eight character serial number. Press any key to return to displaying the present force readings.

11. Recalibrating

Precautions:

- Do not attempt to recalibrate the AF-III unless you fully understand the recalibration procedures below.
- The recalibration procedures require that you press keys on the AF-III Membrane Keypad. These keys must be pressed lightly to avoid jarring the recalibration setup and thereby causing the recalibration to fail.
- The recalibration can be aborted at any step by pressing a key other than the Serial Mode key. However, only the present step and all other remaining steps of the recalibration are aborted. Steps previously completed are not recoverable.

Field recalibration can be performed from the front panel of the AF-III. However, the following restrictions are imposed:

1. You must have a way to mount the AF-III vertically for both tension and compression recalibration.
2. The AF-III will permit recalibration using deadweights within ± 20% of the rated full scale. For example, if you will be recalibrating a 10 Lb. AF-III, your deadweights must be between 8 lb. and 12 lb.
3. The deadweights must be cut to your local gravity or you must know your local gravity, the gravity where the weights were cut to and use one of the following equations to determine what force your deadweights will exhibit:

Equation 1

If your deadweights are cut to international standard gravity:

$$\text{Force} = \text{mass} \times \frac{\text{local gravity}}{980.665 \text{ cm/s/s}}$$

Equation 2

If your deadweights are cut to a gravity other than international standard gravity:

$$\text{Force} = \text{mass} \times \frac{\text{local gravity}}{\text{gravity where weights cut to}}$$

4. The deadweights must be accurate to .025%.
5. You must have a safe method of axially applying the deadweights to the Load Shaft on the AF-III in both tension and compression directions.
6. You must put the AF-III in the units of measure you wish to recalibrate it in before beginning the recalibration (see II.C.2).

The Recalibration function is divided into one set-up step and five calibration steps.

To enter the set-up step of the Recalibration function, momentarily press the Digit key, then momentarily press the Select key three times. The AF-III will respond by displaying the rated capacity in the present units of measure and you will notice a cursor flashing on the right-most digit. At this time, you must change this value (if necessary) to the force exhibited by your deadweights. To change this value, two keys are used. Momentarily pressing the SELECT key increments the value the cursor is on by one if the cursor is over a numerical value or, if the cursor is over the sign position (left-most character on the Display), toggles the sign between blank (for positive) and - (for negative). You do not have to be concerned with the sign. Momentarily pressing the DIGIT key moves the cursor one position to the left. Therefore, to change this value to the force exhibited by your deadweights, simply use the DIGIT key to move the cursor to the positions you wish to change and use the SELECT key at each of these positions to increment the value at the position until the value you wish is shown. Press the Serial Mode key to proceed to Calibration Step 1. The AF-III will respond by displaying STEP 1. Proceed to Calibration Step 1.

Caiibration Step 1
At this time, you must mount the AF-III vertically to calibrate the tension direction and attach any weight carriers, hangars, hooks, etc. that are not part of the force you entered in the set-up step above. These tare weights must not exceed 20% of the rated full scale capacity. Press the Serial Mode key to proceed to Calibration Step 2. If Step 1 is successful, the AF-III will respond by displaying STEP 2; proceed to Calibration Step 2. If Step 1 is not successful, the AF-III will respond by displaying ERROR 1; proceed to Recalibration Errors.

Calibration Step 2
At this time, you must apply the deadweights to the AF-III in the tension direction. Press the Serial Mode key to proceed to Calibration Step 3. If Step 2 is successful, the AF-III will respond by displaying STEP 3; proceed to Calibration Step 3. If Step 2 is not successful, the AF-III will respond by displaying ERROR 2; proceed to Recalibration Errors.

Calibration Step 3
At this time, you must mount the AF-III vertically to calibrate the compression direction and attach any weight carriers, hangars, hooks, etc. that are not part of the force you entered in the set-up step above. These tare weights must not exceed 20% of the rated full scale capacity. Press the Serial Mode key to proceed to Calibration Step 4. If Step 3 is successful, the AF-III will respond by displaying STEP 4; proceed to Calibration Step 4. If Step 3 is not successful, the AF-III will respond by displaying ERROR 3; proceed to Recalibration Errors.

Calibration Step 4
At this time, you must apply the deadweights to the AF-III in the compression direction. Press the Serial Mode key to proceed to Calibration Step 5. If Step 4 is successful, the AF-III will respond by displaying FINISHED; proceed to Calibration Step 5. If Step 4 is not successful, the AF-III will respond by displaying ERROR 4; proceed to Recalibration Errors.

Calibration Step 5
At this time, the recalibration is finished. Press the Serial Mode key to exit the Recalibration function and return to displaying the present force readings. The AF—III will respond by returning to displaying the present force readings.

Recalibration Errors
In the event an error is encountered in the recalibration, the AF-III will display an error message. The possible recalibration error messages displayed by the AF-III and their meanings are:

Error Message	Meaning
ERROR 1	An attempt was made to place more than 20% of the rated full scale capacity on the AF-III in Calibration Step 1.
ERROR 2	The deadweights applied in Calibration Step 2 failed to exhibit a tension force within ±20% of the value entered in the set-up step.
ERROR 3	An attempt was made to place more than 20% of the rated full scale capacity on the AF-III in Calibration Step 3.
ERROR 4	The deadweights applied in Calibration Step 4 failed to exhibit a compression force within ±20% of the value entered in the set-up step.

There is no recovery from an error. To exit the Recalibration Function and return to displaying the present force readings, press any key. The AF-III will respond by aborting the present step and all remaining steps of the recalibration and return to displaying the present force readings.

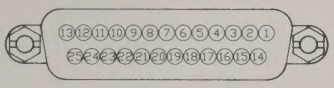
III. SPECIFICATIONS

A. General Specifications
Update Rate: 1000 Hz (updates per second)
Accuracy: ±0.2% of rated full scale ±1 LSD
Load Ranges Available:
0-250 gm.
0-1 lb. (500 gm., 5N., 16 oz.)
0-10 lb. (5 kg., 50 N., 160 oz.)
0-50 lb. (25 kg., 250 N.)
0-100 lb. (50 kg., 500 N.)
0-250 lb. (110 kg., 1100 N.)
0-500 lb. (220 kg.; 2200 N.)

Resolution: 250 gm -0.1 gm.
1 lb.-0.001 lb., 500 gm.-0.1 gm., 5 N.-0.001 N., 16 oz.-0.01 oz.
10 lb.-0.01 lb., 5 kg.-0.001 kg., 50 N.-0.01 N., 160 oz.-0.1 oz.
50 lb.-0.01 lb., 25 kg.-0.01 kg., 250 N.-0.1 N.
100 lb.-0.1 lb., 50 kg.-0.01 kg., 500 N.-0.1 N.
250 lb.-0.1 lb., 110 kg.-0.1 kg., 1100 N.-1 N.
500 lb.-0.1 lb., 220 kg.-0.1 kg., 2200 N.- 1 N.
Full Scale Deflection (approximate):
250 gm.-0.003″
1 lb.-0.006″
50 lb.-0.008″
100 lb. 0.008″
250 lb.0.006″
500 lb.-0.010″
Overload Capacity: 50% of rated full scale. Display reads OVERLOAD when in overload. Capacity Label on front of AF-III indicates rated full scale.
Display: 8 character dot matrix LCD with ⅜″ high characters. Force readings and units of measure are displayed.
Keypad: 12 key membrane with visible feedback (Display blanks) on key closure.
Power Requirement: Rechargeable battery pack (internal) for portable operation. Will operate on 115VAC (60 Hz) or 220 VAC (50 Hz) using appropriately supplied Charger/Converter.
Battery Life: 6-8 hours on a full charge. Display flashes BATTERY every four seconds when batteries are low.
Calibration: Factory calibration is computer controlled using suspended deadweights (NIST traceable). Field recalibration can be performed from the front panel (see II.C.11).
Operating Temperature Range: 50 to 100 degrees Fahrenheit.
Storage Temperature Range: –30 to 130 degrees Fahrenheit.
Gauge Enclosure:
Capacities 100 lb and below:
Aluminum Alloy Number 380. Nominal wall thickness .090″
Capacities above 100 lb:
Aluminum Alloy Number 319.1. Nominal wall thickness .190″.
Gauge Size: 9.08″x3.80″x2.05″(HxWxD)
Carrying Case Size: 13.5″x10″x4.37″ (LxWxD)
Gauge Weight: 1.7 lb.
Shipping Weight (Gauge, Carrying Case and Accessories): 6.8 lb.
Accessories: Charger/Converter, RS-232 Cable, Tension hook, Cone head attachment, Chisel head attachment, Flat head attachment, Vee head attachment and Extension rod.

B. I/O Port Specifications
1. Connector description
The connector used for the AF-III I/O Port is a 25 pin female "D" connector as shown below. If you examine it closely you will notice that the pins on the connector are numbered.

The functions of the pins on the I/O Port are summarized in III.B.2, III.B.3 and III.B.4 below. Note that some of these pins are used for General functions such as the analog output whereas others are used for serial communications functions (RS-232 or Mitutoyo). Also note that some of the pins have two different functions depending on the serial port configuration setting (see II.C.8 for further information).



2. RS-232 Specifications
a. RS-232 I/O Port pin functions

Pin	Symbol	Signal Name	I/O	Function
2	RX	Received data	I	Data to AF-III
3	TX	Transmitted data	O	Data from AF-III
5	CTS	Clear to send	O	Indicates when AF-III is ready to receive commands.
7	SG	Signal ground		Ground
20	DTR	Data terminal ready	I	Indicates when external device is ready to receive data. Internally enabled.

b.RS-232 General Specifications
Communications system: Full duplex serial
Definition: DCE (Modem)
Baud Rate: Selectable 300, 600, 1200, 2400, 4800 or 9600
Start bits: 1
Data bits: 8
Parity: None
Stop bits: 1
Coding: ASCII
Transmission sequence (each character): LSB first
End of transmission delimiter: CR LF

c. RS-232 Output data format
In the RS-232 mode, transmissions from the AF-III take two forms: responses and data.

Responses are basically a reproduction of what is shown on the Display. In some cases where these responses could be confused with actual data (such as high and low set points), prefix identifiers have been added. Responses are transmitted in response to one of the Set-up RS-232 Commands (see III.B.2.d) or in response to a critical condition. The length (number of characters) of responses varies, however, as indicated in III.B.2.b, all responses are delimited by a CR character followed by a LF character.

The possible responses are:

Response	Type	Meaning
OVERLOAD	Critical	AF-III is overloaded.
BATTERY	Critical	AF-III batteries are low.
OFF	Critical	AF-III has been turned off.
AUD. ON	Response	Audible indication is on.
AUD. OFF	Response	Audible indication is off.
DAMP ON	Response	Dampening is on.
DAMP OFF	Response	Dampening is off.
*Hyxxxxxzz	Response	Present value for high set point
*Lyxxxxxzz	Response	Present value for low set point

*y is the sign; blank for positive or - for negative. xxxxx are the digits and decimal point, i.e. 1.245, 10.35 zz are the units of measure. i.e. Lb, N.

Data will be transmitted in reponse to one of the Data RS-232 Commands (see III.B.2.d) or in response to the SEND button on the Membrane Keypad being momentarily pressed. The length (number of characters) of data is constant at 11 characters (including the CR and LF end of transmission delimeters).

Data will take the form:

Character 1 - P, V, or Space

P—Specifies the data is peak compression data

V—Specifies the data is peak tension data

Space—Specifies the data is present data

Character 2 - (–) sign or Space

(–) sign—specifies the data is negative

Space—specifies the data is is positive

Character 3 through Character 7 - Contain the digits and decimal point. For example, if the AF-III Display is reading 10.45 Lb:

Character 3 = 1
Character 4 = 0
Character 5 = .
Character 6 = 4
Character 7 = 5

Character 8 and Character 9 - Contain the units of measure. For example, if the AF-III Display is reading 10.45 Lb:

Character 8 = L
Character 9 = b
Character 10 - CR (Carriage Return)
Character 11 - LF (Line Feed)

d. RS-232 Commands

The full duplex serial communications capability of the AF-III permits remote control of AF-III functions via the serial port. AF-III functions are controlled through the following single character "commands":

Input comman	Type	Function
U or u	Set-up	Same function as UNITS key on Membrane Keypad (see II.C.2).
Z or z	Set-up	Same function as ZERO key on Membrane Keypad (see II.C.3).
P or p	Data	Same function as PEAK key on Membrane Keypad (see II.C.4) with the exception that the peak compression reading is always brought up first.
V or v	Data	Same function as PEAK key on Membrane Keypad (see II.C.4) with the exception that the peak tension reading is always brought up first.
C or c	Set-up	Same function as CLEAR key on Membrane Keypad (see II.C.5).
H or h	Set-up	Same function as SET HIGH key on Membrane Keypad (see II.C.6).
L or l	Set-up	Same function as SET LOW key on Membrane Keypad (see II.C.6).
I or i	Set-up	Same function as SELECT key on Membrane Keypad.
D or d	Set-up	Same function as DIGIT key on Membrane Keypad.
M or m	Set-up	Same function as DAMP key on Membrane Keypad (see II.C.7).
O or o	Set-up	Same function as SERIAL MODE key on Membrane Keypad (see II.C.8).
Space bar	Data	Same function as SEND key on Membrane Keypad (see II.C.9).
S or s	Data	Start continuous transmissions.
E or e	Data	Stop continuous transmissions.

3. Mitutoyo Specifications

a. Mitutoyo I/O Port pin functions

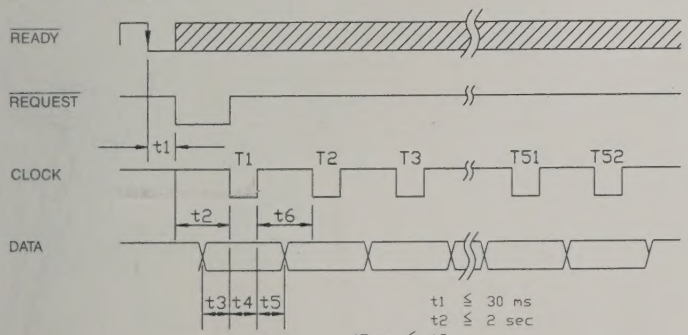
Pin	Signal Name	I/O	Function
3	Clock	O	Clock for data transmission
5	Ready	O	Logic 0 indicates AF-III is ready for data transmission. Logic 1 indicates it is not.

Pin	Signal Name	I/O	Function
7	Signal ground	-	Ground
16	Data	O	Measurement data
20	Request	I	Logic 0 requests data from AF-III.

b. Mitutoyo General Specifications
Communications system: Unidirectional serial
Coding: 4 bit (8-4-2-1) BCD
Transmission sequence (each digit):
LSB first

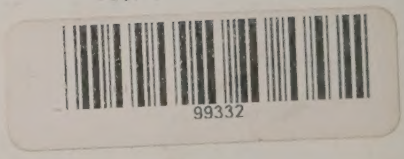
c: Mitutoyo Output data format
In the Mitutoyo mode, transmissions from the AF-III are always data. Each transmission consists of 13 digits (d1 thru d13) in the following form:
Digit 1 thru Digit 4—All F (1111)
Digit 5—Contains the sign: 0 (0000): +
8 (1000): –
Digit 6 thru Digit 11—
Contain the measurement data. Digit 6 is the MSD, digit 11 is the LSD. Since the AF-III uses only four digits for measurement data, Digit 6 and Digit 7 will always be zero. For example, if the AF-III Display is reading 12.35:
Digit 6 = 0 (0000)
Digit 7 = 0 (0000)
Digit 8 = 1 (0001)
Digit 9 = 2 (0010)
Digit 10 = 3 (0011)
Digit 11 = 5 (0101)
Digit 12 = Decimal point location. Since the AF-III uses only four digits for measurement data, this digit will only ever be 0, 1, 2, or 3.
xxxxxx. = 0 (0000)
xxxxx.x = 1 (0001)
xxxx.xx = 2 (0010)
xxx.xxx = 3 (0011)
For example, if the AF-III is reading 28.95, Digit 12 will be equal to 2 (0010).
Digit 13—Contains the units of measure. Will always be F (1111): none.

d. Mitutoyo Timing diagram



4. General Function Specifications
a. General Function I/O Port pin functions

Pin	Signal Name	I/O	Function
7	Signal ground	-	Ground
9	High set point status	O	Logic 1 when high set point has been reached or exceeded. Logic 0 otherwise.
10	Low set point status	O	Logic 1 when low set point has been reached or exceeded. Logic 0 otherwise.
11	Analog output	O	±1 VDC full scale analog signal. Positive voltages represent compression, negative voltages represent tension. This is not a digitized signal.



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